Claims

We claim:

1. A method for controlling transmission latency in a communications system, wherein the communications system is subject to a noise signal having at least a first noise phase and a second noise phase, the method comprising:

determining a first bit rate for symbols transmitted during the first noise phase, and a second bit rate for symbols transmitted during the second noise phase, the first bit rate and the second bit rate being constrained such that a transmission latency does not exceed a pre-determined maximum allowed transmission latency; and

transmitting symbols at the first bit rate during the first noise phase and at the second bit rate during the second noise phase.

2. A method according to claim 1, further comprising communicating the predetermined maximum allowed transmission latency via a message to a receiver of the communications system.

3. A method according to claim 2, the method further comprising:

configuring, in accordance with the first bit rate, a first bit allocation table for symbols transmitted during the first noise phase; and

configuring, in accordance with the second bit rate, a second bit allocation table for symbols transmitted during the second noise phase.

4. An apparatus for controlling transmission latency in a communications system, wherein the communications system is subject to a noise signal having at least a first noise phase and a second noise phase, the apparatus comprising:

a constrained rate receiver for determining a first bit rate for symbols transmitted during the first noise phase, and a second bit rate for symbols transmitted during the second noise phase, the first bit rate and the second bit rate being constrained such that a transmission latency does not exceed a predetermined maximum allowed transmission latency; and

a constrained rate transmitter for transmitting symbols at the first bit rate during the first noise phase and at the second bit rate during the second noise phase.

5. An apparatus according to claim 4, wherein the constrained rate transmitter further comprises a latency control transmitter for communicating the predetermined maximum allowed transmission latency via a message to the constrained rate receiver.

6. An apparatus according to claim 5, wherein the constrained rate receiver further comprises:

a first bit allocation table controller for configuring, in accordance with the first bit rate, a first bit allocation table for symbols transmitted during the first noise phase; and

a second bit allocation table controller for configuring, in accordance with the second bit rate, a second bit allocation table for symbols transmitted during the second noise phase.

7. A constrained rate receiver for controlling transmission latency in a communications system, wherein the communications system is subject to a noise signal having at least a first noise phase and a second noise phase, the receiver being adapted to determining a first bit rate for symbols transmitted during the first noise phase, and a second bit rate for symbols transmitted during the second noise phase, the first bit rate and the second bit rate being constrained such that a transmission latency does not exceed a predetermined maximum allowed transmission latency.

8. A constrained rate transmitter in a communications system, wherein the communications system is subject to a noise signal having at least a first noise phase and a second noise phase for transmitting symbols at the first bit rate during the first noise phase and at the second bit rate during the second noise phase, whereby the first bit rate and the second bit rate are determined in a constrained rate receiver according to claim 7.

9. A transmitter according to claim 8 further comprising a latency control transmitter for communicating the predetermined maximum allowed transmission latency via a message to a constrained rate receiver.

10. A constrained rate receiver according to claim 7, capable of receiving a message communicating the predetermined maximum allowed transmission latency.

11. A constrained rate receiver according to claim 10, further comprising:

a first bit allocation table controller for configuring, in accordance with the first bit rate, a first bit allocation table for symbols transmitted during the first noise phase; and

a second bit allocation table controller for configuring, in accordance with the second bit rate, a second bit allocation table for symbols transmitted during the second noise phase.

12. A constrained rate receiver according to claim 11 wherein the first noise phase corresponds to a first signal-to-noise ratio, and the second noise phase corresponds to a second signal-to-noise ratio, the second signal-to-noise ratio being higher than the first signal-to-noise ratio further comprising:

a second bit rate controller for determining the second bit rate based on the second signal-to-noise ratio.

13. A constrained rate receiver according to claim 12 further comprising: a first bit rate controller for determining the first bit rate based on the second bit rate and the pre-determined maximum allowed transmission latency.

14. A constrained rate receiver according to claim 13, wherein the first bit rate controller comprises a controller for determining the first bit rate in accordance with the following equation:

$$R_1 = -R_2 * \left(\frac{S_2}{S_1}\right) * \frac{(latency * C + SymTime * S_1)}{(latency * C + SymTime * S_2)}$$

where R_1 is the first bit rate, R_2 is the second bit rate, *latency* is the predetermined maximum allowed transmission latency, and *SymTime* is a discrete multi-tone symbol duration, for S_2 symbols of the second noise phase transmitted during a number C of noise clock cycles and S_1 symbols of the first noise phase transmitted during the number C of noise clock cycles.

15. A constrained rate receiver according to claim 14, operating in a communications system which is an adaptive rate communications system.

16. A constrained rate receiver according to claim 15 wherein the communications system is an asymmetric digital subscriber line communications system.

17. A signal in a communications system, wherein the communications system is subject to a noise signal having at least a first noise phase and a second noise phase, the signal comprising:

a determined first bit rate for symbols transmitted during the first noise phase, and a second bit rate for symbols transmitted during the second noise phase, the first bit rate and the second bit rate being constrained such that a transmission latency does not exceed a pre-determined maximum allowed transmission latency; and

symbols transmitted at the first bit rate during the first noise phase and at the second bit rate during the second noise phase, such that the transmission latency in the communications system can be controllable.

18. A signal according to claim 17, further comprising a message representing the predetermined maximum allowed transmission latency.

19. A signal according to claim 18, further comprising:

symbols transmitted during the first noise phase from a first bit allocation table configured in accordance with the first bit rate; and

symbols transmitted during the second noise phase from a second bit allocation table configured in accordance with the second bit rate.

20. A signal according to claim 19, wherein the first noise phase corresponds to a first signal-to-noise ratio, and the second noise phase corresponds to a second signal-to-noise ratio, the second signal-to-noise ratio being higher than the first signal-to-noise ratio, wherein

the second bit rate is determined on the basis of the second signal-to-noise ratio.